DISCOVERY

Proximate analysis of Coconut (*Cocos nucifera*) endocarp

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ABSTRACT
The proximate composition of three different coconut endocarp samples was investigated. Coconut (*Cocos nucifera*) endocarp was observed to have high percentage of lipid (51.83%) than other nutritional contents analyzed in the proximate composition. Moisture content was (36.86%), fibre (12.85%), carbohydrate (9.76%), protein (6.93) and ash (1.75%). The proximate composition of coconut endocarp was investigated. The result aims at elucidating the proximate composition studied so far with regards environmental variations as no work of such has been done in the study area or environment.

Keywords: Coconut, endocarp, nutrition, proximate analysis.

Abbreviation: AOAC - Association of Official Analytical Chemicals, SD – Standard deviation.

1. INTRODUCTION
Botanically a coconut (*Cocos nucifera*) is a simply dry nut known as fibrous drops. The husk, or mesocarp, is composed of fibres called coir and there is an inner strong or endocarp. The white, fleshy and edible part of the seed (the endosperm) begins to form in the side of the fruit. At 7 months, the endosperm develops in the entire inside of the fruit, but it is not consistent. At 10 months, the endosperm is completely ripe, and the endocarp or peel is dark and hard.

Scope of the study
Coconut being an edible fruit grown in the tropics with little research work appeared to have been done in this region (Nigeria) recently with respect to determination of the proximate composition of its endocarp. Therefore, this work aims to elucidate the proximate composition (% protein, carbohydrate, lipids, and moisture, fibre and ash contents) of its endocarp.

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2. MATERIAL AND METHODS

2.1. Materials

Weighing balance, electric oven, heating mantle, Pasteur pipette, thermostatic water bath, etc.

2.1.1. Apparatus and reagents

All reagents and apparatus were of laboratory standard.

2.2. Methodology

2.2.1. Sample collection/Source

Three (3) different species of Coconut were bought from Aluu market in Port Harcourt, Rivers State and was taken to the laboratory.

2.2.2. Sample Preparation

The samples (Coconut) were broken and the waters decanted from it. The coconut is sliced into bits and then crushed in a small ceramic crucible. After crushing the samples, they were weighed into different test tubes.

2.3. Experimental analysis

Proximate analysis was carried out on the three (3) Coconut samples and it involves the analysis of percentage (%) composition of the macro molecules or nutrients present in the test sample. The method adopted for the proximate analysis of parameters like; moisture and ash contents, as well as crude lipid was that of the Association of Official Analytical Chemicals (AOAC, 1984). While crude protein content determination was done using macro Kjeldahl Markham distillation techniques with reference to the Kjeldehl (1965) method for organic nitrogen. Carbohydrate determination was done using Clegg Anthrone method. The sample(s) was digested by hydrolysis of starch together with soluble sugars and determined calorimetrically by Clegg Anthrone method and expressed as percentage glucose.

Table 1 Sample A (Pear Shaped Coconut)

Moisture	Ash	Lipid	Protein	Carbohydrate	Fibre
31.20%	1.49%	34.47%	8.13%	10.57%	5.44%

The results are mean ± SD of triplicate determination of individual nutrient.

Table 2 Sample B (Native Coconut)

Moisture	Ash	Lipid	Protein	Carbohydrate	Fibre
39.90%	1.34%	89.63%	7.39%	9.57%	20.87%

The results are mean ± SD of triplicate determination of individual nutrient.

Table 3 Sample C (Native Round Coconut)

Moisture	Ash	Lipid	Protein	Carbohydrate	Fibre
39.50%	2.43%	31.39%	5.29%	9.14%	12.25%

The results are mean ± SD of triplicate determination of individual nutrient.

For crude fibre content, it was determined by calculating the difference between 100% and the summation of the percentages of protein, carbohydrate, moisture, ash, and lipid.

2.4. Calculation

Crude Fibre = 100% – (% protein + % carbohydrate + % moisture + % Ash + % lipid)

3. RESULTS AND DISCUSSION

The results of proximate analysis for the three samples are shown in the tables 1, 2 & 3. The proximate analysis carried out on 3 different shapes of coconut sample and their values were shown in tables 1, 2 & 3. The value and percentage moisture in sample A shows that it has high moisture content, indicating that if not properly reserved, makes it easy for microorganisms (bacteria) to strive and survive under such environment, which may result to easy deterioration. The ash content of the coconut which is the lowest indicates that it is not a good source of mineral element needed for growth and development of body tissues. The lipid value shows

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that it is the highest content of the three (3) major nutrients but not a good source of lipid needed for proper synthesis of cell membrane. The protein value of the coconut shows that it's low and the least among the three (3) major nutrients needed in diet, which means it is not a good source of protein. The value and percentage of carbohydrate in sample A shows that it is low but not as low as protein and ash content. The low percentage of the carbohydrate makes it not a good source of energy production. The fibre content in sample A is very low though not as low as ash content which indicates that the digestion will not be fast. For sample B, the value and percentage of moisture in sample B is higher than that of sample A.

The ash content of sample B is lower than that of sample A which indicates that it is not a good source of mineral element needed for growth and development of body tissues. The lipid content shown in table 2 indicates that it has the highest value compared to other samples studied, which makes it a very good source of lipid needed for proper synthesis of cell membrane when compared to samples A and C. The protein value of sample B shows that it is low compared to that of sample A, indicating that it is not a good source of protein compared to sample A. The value and percentage of carbohydrate in sample B shows that, sample A is higher than that of sample B. Fibre content of sample B is higher than that of samples A and B, indicating that it can ease digestion. For sample C, the moisture content is low compared to that of sample B but higher than that of sample A. The ash content of sample C is higher than that of sample A and B making it a better source of mineral than does samples A and B. The lipid content for sample C is lower than that of Sample A and B which means sample C has lesser oil compared to that of samples A and B. The protein content of sample C is lower than that of sample A and B which indicates it is not a good source of protein compared to samples A and B. The carbohydrate and lipid contents of sample C is lower than that of sample A and B which indicates that it is not a good source of energy when compared to samples A and B. The fibre content of sample C is high though not as high as that of sample B but higher than sample A, indicating that it can ease digestion.

4. CONCLUSION

The nutritional values of coconut have shown that it is high in lipid and moisture content making it a good source of lipid needed for proper synthesis. From the result above, it appears that Coconut is not a good source of mineral element needed for the growth and development of body tissue because of its low ash content and also, it is not a good source of energy due to its low carbohydrate percentage. The lipid content of samples A and B is higher than their moisture content which indicates that samples A and B has much oil than water unlike sample C which has more moisture than lipid hence, more water than oil.

SUMMARY OF RESEARCH

1. This work has within the limit of available analytical resource and tool, provided useful information as to the proximate composition (nutritional and mineral) of coconut endocarp.
2. The research findings will serve as a pointer to consumers as to what to expect (nutritionally) when or after consumption of the fruit.

FUTURE ISSUES

From the findings, it is advised that future work be carried out with respect to phytochemical analysis of various species of coconut endocarp.

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Conflict of Interest

The authors declare no conflicts of interests any matter related to this paper.

Data and materials availability

All related data have been presented in this paper.

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